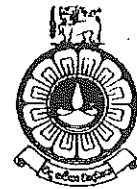


THE OPEN UNIVERSITY OF SRI LANKA
DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE
B. SC. DEGREE PROGRAMME 2021/2022
FINAL EXAMINATION
CSU5307: DATA COMMUNICATION
DURATION: TWO HOURS (2 HOURS)



071

Date: 31.10.2022

Time: 9.30am – 11.30 am

Question 1 is compulsory. Answer **FIVE** Questions. All questions carry equal marks.

Q1. Explain the following Technologies. Use diagrams when necessary.

- i. Data Link Layer
- ii. HTTPS
- iii. LTE
- iv. HLR
- v. MSISDN

Q2. Digital data can be transferred through a transmission medium in the form of digital signals.

- i. State three digital encoding schemes and discuss the advantages and disadvantages of each scheme.
- ii. Draw the signal diagram for each of the above if the transmitted digital data stream is 110110101.
- iii. Discuss why digital signals are not affected by noise.

Q3. Input signal of a modulation systems is $x(t)$ and carrier signal is, $\text{Cos}(2\pi f_c t)$. output signal after modulation is given as,

$$S(t) = A.[1 + \mu.(t)]. \text{Cos}(2\pi f_c t)$$

μ is known as modulation index and A is the amplitude of the output signal. The 1 represents the **DC** component to prevent loss of information. Clearly stating the assumptions, answer the following questions.

- i. Identify the modulation system.
- ii. Where are such systems used in communications?

- iii. Draw the time domain output signal, when $x(t)$ is a sinusoidal signal with frequency of f_c and $f_c = 5 \times f_1$ with similar amplitude.
- iv. Draw the frequency spectrum for the output signal for double sideband transmitted carrier (DSBTC).

Q4.

- i. Explain the requirement of TDM (Time Division Multiplexing) and FDM (Frequency Division Multiplexing) systems in data communication.
- ii. Draw a diagram and clearly explain the functions of **both of the above** using four channels (A_1, A_2, A_3, A_4), in a transmitter, transmission medium, and de-multiplexing at the receiver.
- iii. Identify the differences in **TDM and FDM**.
- iv. Briefly explain a practical example for **FDM and TDM used together**.

Q5. A Music Video file of 256 MB (megabytes) is saved in a server. Transmission channel from the server to the client PC is capable of handling 8 Mbps (megabits per second) data rate. Transmission system is using an analog modulation scheme of ASK (Asy... SK....),

- i. Design a system of bits to signal mapping to achieve a minimum **Signal rate**.
- ii. State the sinusoidal notation of the transmitted signal.
- iii. Calculate the time taken to download the file to the PC.
- iv. What are the other types of modulation schemes which can be used to transmit digital data through analog signals?

Q6. A Radio DJ's voice signal is sampled at a rate of 44 kHz in **radio station A**. The sampling is done without compression and 256 levels in quantization.

- i. What is the **bit rate** of the generated PCM signal?
- ii. Draw a sampling diagram in the time domain.
- iii. What is the minimum bit rate required to transmit the voice through a PCM channel with a similar number of quantization levels and input voice signal bandwidth of 32 kHz.?
- iv. What could be done to reduce the quantization error by half for both cases?

***** End of Paper*****